Claims

1. Method for producing an ultrabarrier layer system through vacuum coating a substrate with a layer stack that is embodied as an alternating layer system of smoothing layers and transparent ceramic layers, but comprising at least one smoothing layer between two transparent ceramic layers, which are applied by sputtering, characterized in that during the deposition of the smoothing layer a monomer is admitted into an evacuated coating chamber in which a magnetron plasma is operated.

2. Method according to claim 1, characterized in that during the deposition of the smoothing layer the magnetron plasma is operated in a pulsed manner with a pulse frequency of 1 kHz to 300 kHz.

3. Method according to claim 1 or 2, characterized in that to maintain the magnetron plasma during the deposition of the smoothing layer a magnetron is used that is equipped with a target that is made of a material that can be reactively converted with nitrogen or oxygen.

4. Method according to at least one of claims 1 through 3, characterized in that a double magnetron is used to maintain the plasma during the deposition of the smoothing layer.

5. Method according to at least one of claims 1 through 4, characterized in that a noble gas is used as a working gas.

6. Method according to at least one of claims 1 through 5, characterized in that hydrocarbons, silanes, Si-organics or organometallics are admitted as monomers.

7. Method according to at least one of claims 1 through 6, characterized in that oxygen, nitrogen and/or hydrogen is admitted as reactive gas in addition to the admission of monomers during the deposition of the smoothing layer.

8. Method according to at least one of claims 1 through 7, characterized in that a process pressure of 0.1 Pa to 10 Pa is set during the deposition of the smoothing layer.

9. Method according to at least one of claims 1 through 8, characterized in that the deposition of the transparent ceramic layers takes place through magnetron sputtering.

10. Method according to claim 9, characterized in that the deposition of the transparent ceramic layers takes place through reactive magnetron sputtering, whereby nitrogen, oxygen, and/or hydrogen is admitted as reactive gas.

11. Method according to at least one of claims 1 through 10, characterized in that Al_2O_3 is deposited as a transparent ceramic layer.

12. Method according to at least one of claims 1 through 10, characterized in that SiO_2 is deposited as a transparent ceramic layer.

13. Method according to at least one of claims 1 through 10, characterized in that SiN is deposited as a transparent ceramic layer.

14. Method according to at least one of claims 1 through 13, characterized in that the coating takes place on stationary substrates.

15. Method according to at least one of claims 1 through 13, characterized in that the coating takes place on moving band-shaped substrates.

16. Method according to at least one of claims 1 through 15, characterized in that the substrate temperature is kept at below 200°C during the coating.

17. Method according to at least one of claims 1 through 16, characterized in that the coating takes place on plastic substrates.

18. Method according to at least one of claims 1 through 17, characterized in that the coating rates and/or the substrate speed are adjusted such that plasma polymer layers are deposited as smoothing layers with a layer

thickness of 50 nm to 5 μm and transparent ceramic layers are deposited with a layer thickness of 5 nm to 500 nm.

19. Method according to at least one of claims 1 through 18, characterized in that the alternating layer system is deposited by means of a magnetron arrangement in the plasma of which alternately a monomer and a reactive gas is admitted.

20. Method according to claim 19, characterized in that the deposition of the alternating layer system takes place through the alternating admission of HMDSO and oxygen.

21. Method according to claim 19 or 20, characterized in that during the deposition of the alternating layer system the flows of monomer and reactive gas and/or working gas admitted are gradually changed and at least at times occur simultaneously so that individual layers of the alternating layer system merge into one another in a gradient form.

22. Method according to at least one of claims 19 through 21, characterized in that reactive gas and monomer are admitted via a common gas intake.

23. Method according to at least one of claims 1 through 18, characterized in that the alternating layer system is deposited by means of at least one magnetron arrangement and the admission of monomer and reactive gas and/or working gas takes place at different sites so that the layers of the alternating layer system are deposited successively when passing through the coating region on a moving substrate.

24. Method according to at least one of claims 1 through 18, characterized in that the alternating layer system is deposited by means of at least one magnetron arrangement and the admission of monomer and reactive gas and/or working gas takes place at different sites so that a clear partial pressure gradient between the admitted gases develops in the region of the magnetron plasma such that when passing through the coating region

on a moving substrate layers are successively deposited which merge into one another in a gradient form.

25. Method according to claim 23 or 24, characterized in that a moving substrate is guided through the coating region several times.

26. Method according to one of claims 23 through 25, characterized in that the deposition of the alternating layer system takes place through the simultaneous admission of HMDSO and oxygen.

27. Method according to at least one of claims 23 through 26, characterized in that reactive gas and working gas are admitted via a common gas intake.